Relative Intensity Noise Reduction by Optimizing Fiber Grating Fabry-Perot Laser Parameters.

ABSTRACT

A set of nonlinear rate equations that can describe an external cavity laser with any arbitrary external optical feedback (OFB) level are derived. A comprehensive study on the relative intensity noise (RIN) characteristics of a fiber grating Fabry-Perot is performed numerically. In this paper, fiber Bragg grating (FBG) is used as a wavelength lasing selective element to control the external OFB level, thereby control the RIN. In addition to the external OFB level, the effect of other external cavity parameters such as temperature, injection current, cavity volume, gain compression factor, and FBG parameters on RIN characteristics is investigated. The temperature dependence (TD) of RIN is calculated according to TD of laser parameters instead of well-known Parkove relationship. Results show that by optimization, the peak value of the RIN can be reduced down to around -150 dB/Hz. The optimum and the shortest external cavity length that provides the minimum RIN is found to be around 3.1 cm. In addition, by optimization, the relaxation oscillation frequency of RIN spectra is shifted toward around 5.6 GHz.

Keyword: External cavity; Fiber Bragg grating; Optical feedback; relative intensity noise; Semiconductor lasers; Wavelength-division multiplexing